

Application Note #2512

Using the RIO Pocket PLC as External I/O for a Galil controller

In control applications where the I/O requirement is large – there may not be enough inputs or outputs on a Galil controller to handle the total number of desired I/O points. If that is the case, then there are a couple of different solutions for the user to consider depending on the hardware. One solution is to add in the RIO Pocket PLC via an Ethernet connection. This application note describes how to connect from any Galil Ethernet controller to an RIO Pocket PLC.

Ethernet Network Considerations

Before we launch ourselves into the application, let's first consider the possible ways to connect the DMC controller and the RIO via Ethernet. The two diagrams below show possible ways of having an Ethernet connection between the controller and RIO.

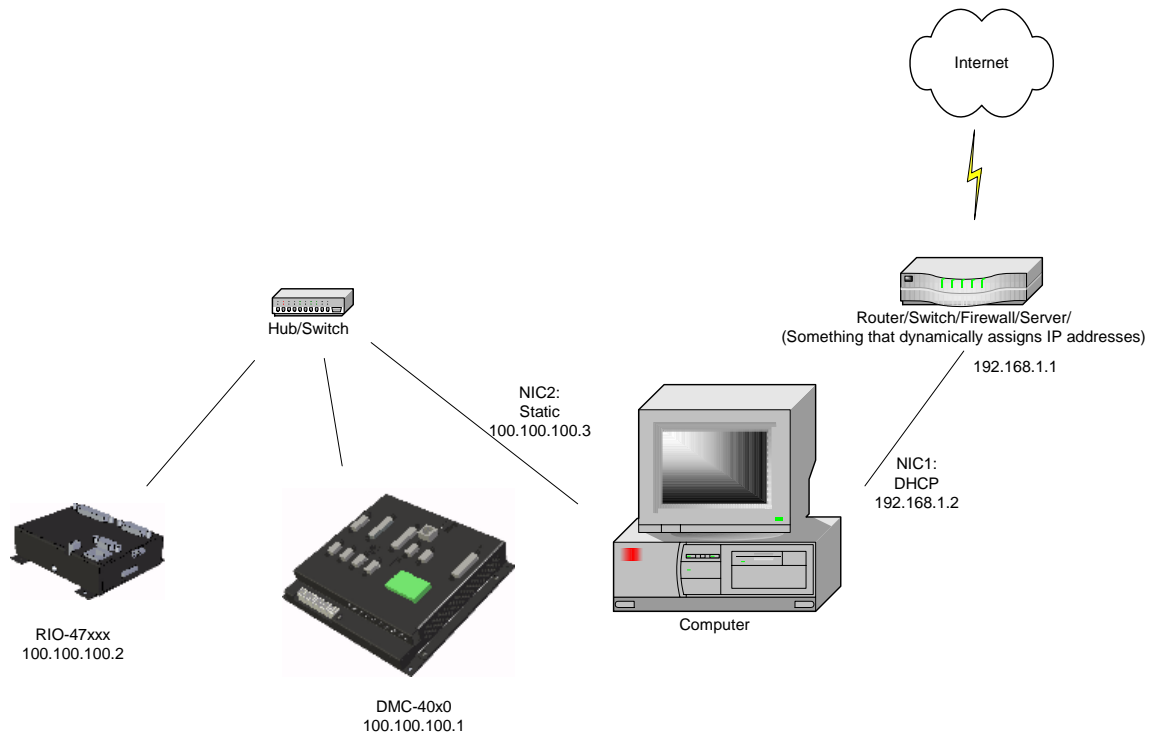


Figure 1: Ethernet Configuration using Hub/Switch between controller and RIO

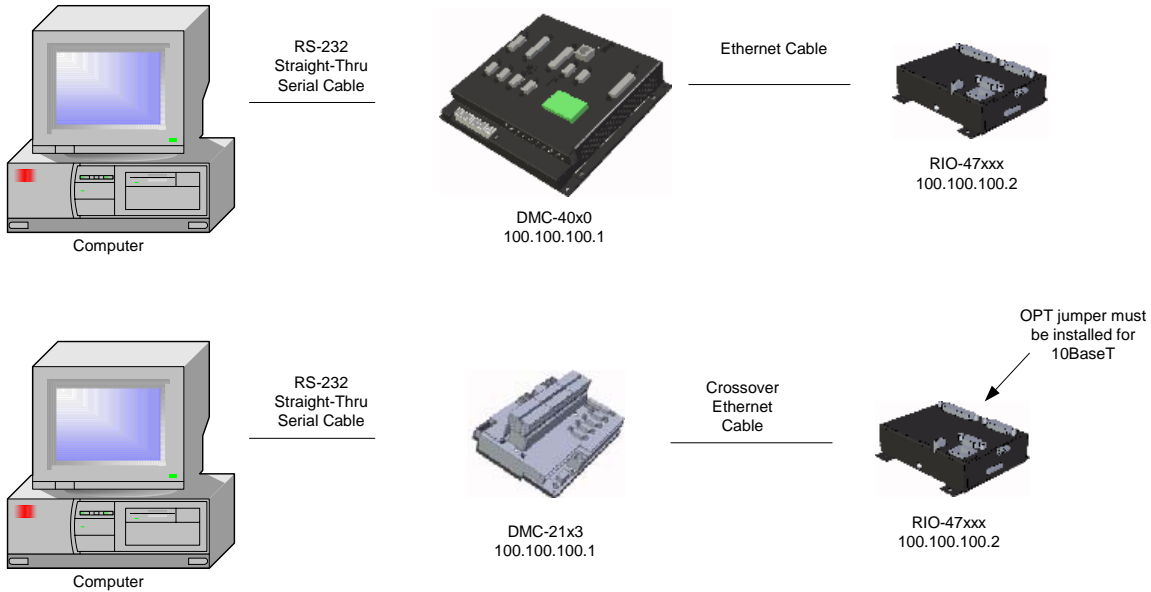
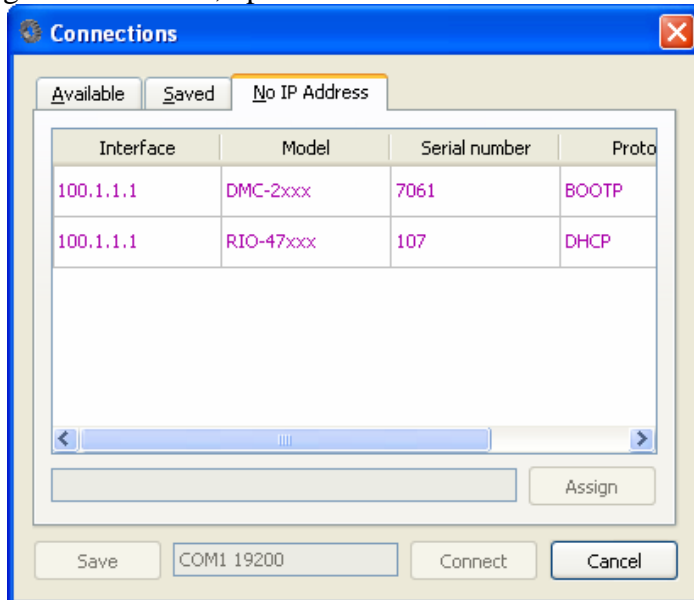


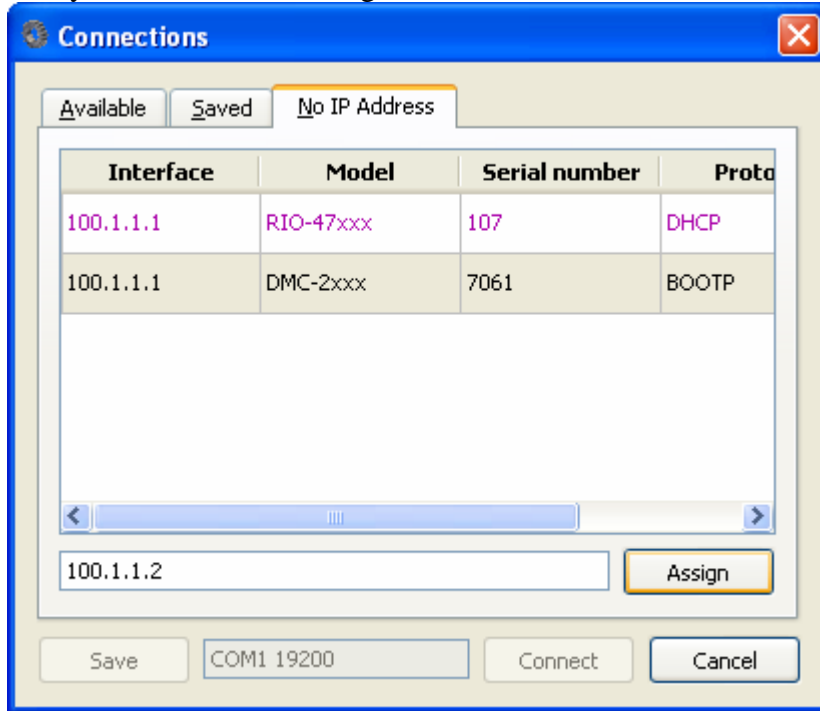
Figure 2: Ethernet configuration using direct Ethernet connection between controller and RIO

Steps to Communicate between controller and RIO

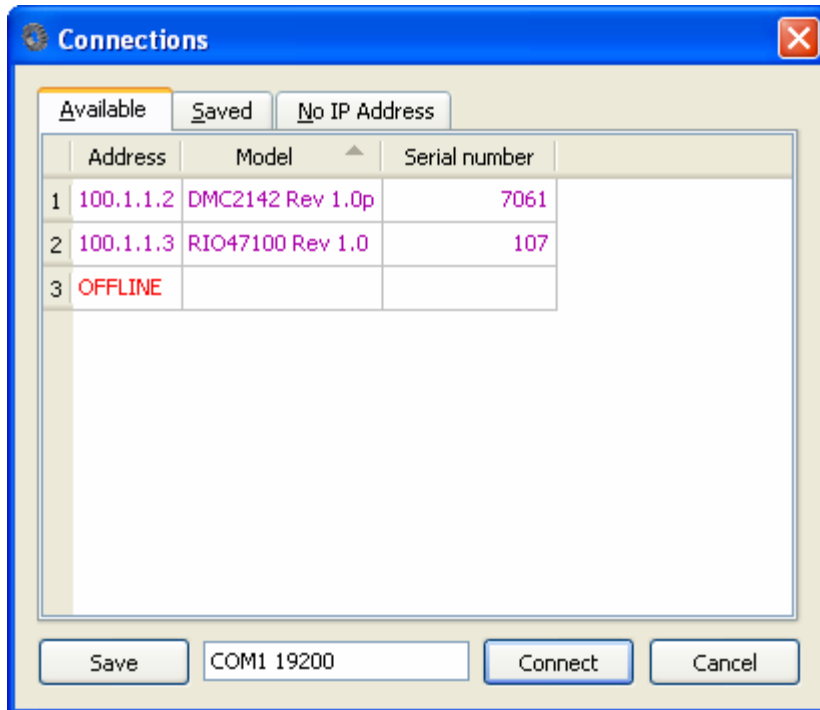
1. Check cable connections. Make sure that the Link Light for the controller and RIO are both ON signifying that the Ethernet connection between the two is valid. If using a 10BaseT controller such as the DMC-21x3 or DMC-14x5 via a direct crossover cable to the RIO (as shown in Figure 2), make sure that the OPT jumper is ON in order to force the RIO to use 10BaseT communication.
2. Assign both units an IP address. This can be done over Ethernet via the GalilTools software. It is recommended to NOT use a DHCP network – the controller and RIO should have static IP addresses (DH0 for RIO and DMC-40x0). To assign an IP address, open GalilTools and click the No IP Address tab:



Click on the unit, type in the IP address or use the one that comes up automatically, and then click “Assign”.



Once you have done that for both the controller and RIO, you can click on the Available tab to see them:



Assigning an IP address can also be done over a serial connection by issuing the IA command and then burning it in:

```
:IA100,1,1,2
:IA?
100, 1, 1, 2
:BN
```

3. Once you have assigned the IP address to both units, use GalilTools to connect to the controller and issue the TH command:

```
TH
CONTROLLER IP ADDRESS 100,1,1,2 ETHERNET ADDRESS 00-50-4C-00-1B-95
IHA TCP PORT 23 TO IP ADDRESS 100,1,1,1 PORT 3091
IHB UDP PORT 60007 TO IP ADDRESS 100,1,1,1 PORT 3092
IHC AVAILABLE
IHD AVAILABLE ...
```

This shows the available handles. In this case, because we have connected to the controller over Ethernet using GalilTools – the first two handles are taken. We need to use Handle C to connect to the RIO. The IH command is what creates a new handle to connect to the RIO:

```
:IHC=100,1,1,3
:TH
CONTROLLER IP ADDRESS 100,1,1,2 ETHERNET ADDRESS 00-50-4C-00-1B-95
IHA TCP PORT 23 TO IP ADDRESS 100,1,1,1 PORT 3091
IHB UDP PORT 60007 TO IP ADDRESS 100,1,1,1 PORT 3092
IHC TCP PORT 1012 TO IP ADDRESS 100,1,1,3 PORT 1000
IHD AVAILABLE ...
```

The TH shows that we are connected to the RIO on handle C. You can now issue commands with the format of: $I/O\ Number = (HandleNum * 1000) + (bitNum)$ so in order to set and clear digital output bit 1 on the RIO, you can issue:

```
:SB3001
:CB3001
```

The controller and RIO are now communicating with each other.

In order to automate the connection process – the user can download a program that automatically runs at startup to initiate the connection. Below is a sample program that establishes a connection on handle A and toggles bit 1 in a loop. Download the following code and then issue the BP command to burn it into the controller. The #AUTO label will cause it to automatically run at power-up.

```
#AUTO
WT3000; 'Wait 3 seconds before trying Ethernet communication
IHA=100,1,1,3>2
#LOOP
JP#LOOP, __IHA2<>-2; 'Wait for handle to connect
#TOGGLE
SB1001
WT500
CB1001
WT500
JP#TOGGLE
```

Useful Commands for Controller to RIO communication

Command	Description	Example	Meaning
SBn	Set Digital Output	SB1001	Set output 1 on handle A
CBn	Clear Digital Output	CB1001	Clear output 1 on handle A
AOn,m	Set Analog Output n to a value of m	AO1002,3.3	Set analog output 2 on handle A to 3.3V
@IN[n]	Digital Input value	MG@IN[1001]	Display value of Digital Input 1 on handle A
@OUT[n]	Digital Output value	MG@OUT[1001]	Display value of Digital Output 1 on handle A
@AN[n]	Analog Input value	MG@AN[1001]	Display value of Analog Input 1 on handle A
@AO[n]	Analog Input value	MG@AO[1001]	Display value of Analog Output 1 on handle A

SA Command

The SA command allows for any command to be sent over the Ethernet from one controller to another. This could be useful in situations such as sending variables back and forth between the controller and the RIO. To send a variable labeled “TurnOn” from the controller to the RIO, you can issue the following command:

```
SAA="TurnOn=5"
```

To query the value of a variable located on the RIO:

```
:SAA="MG TurnOn"
```

```
:MG_SAA
```

```
5.0000
```